

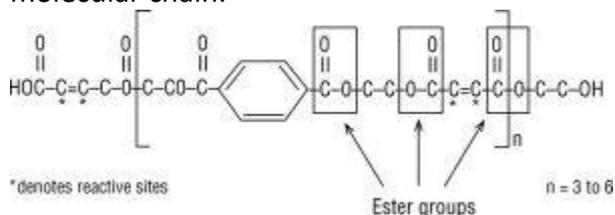
POLYESTER RESINS

Polyester resins are the most widely used resin systems, particularly in the marine industry. By far the majority of dinghies, yachts and workboats built in composites make use of this resin system.

Polyester resins such as these are of the 'unsaturated' type. Unsaturated polyester resin is a thermoset, capable of being cured from a liquid or solid state when subject to the right conditions. It is usual to refer to unsaturated polyester resins as 'polyester resins', or simply as 'polyesters'. There is a whole range of polyesters made from different acids, glycols and monomers, all having varying properties.

There are two principle types of polyester resin used as standard laminating systems in the composites industry. Orthophthalic polyester resin is the standard economic resin used by many people. Isophthalic polyester resin is now becoming the preferred material in industries such as marine where its superior water resistance is desirable.

The figure below shows the idealised chemical structure of a typical polyester. Note the positions of the ester groups (CO – O – C) and the reactive sites (C* = C*) within the molecular chain.



Most polyester resins are viscous, pale coloured liquids consisting of a solution of a polyester in a monomer which is usually styrene. The addition of styrene in amounts of up to 50% helps to make the resin easier to handle by reducing its viscosity. The styrene also performs the vital function of enabling the resin to cure from a liquid to a solid by 'cross-linking' the molecular chains of the polyester, without the evolution of any by-products. These resins can therefore be moulded without the use of pressure and are called 'contact' or 'low pressure' resins. Polyester resins have a limited storage life as they will set or 'gel' on their own over a long period of time. Often small quantities of inhibitor are added during the resin manufacture to slow this gelling action.

For use in moulding, a polyester resin requires the addition of several ancillary products.

These products are generally:

- **Catalyst**
- **Accelerator**
- **Additives: Thixotropic; Pigment; Filler; Chemical/fire resistance**

A manufacturer may supply the resin in its basic form or with any of the above additives already included. Resins can be formulated to the moulder's requirements ready simply for the addition of the catalyst prior to moulding. As has been mentioned, given enough time an unsaturated polyester resin will set by itself. This rate of polymerisation is too slow for practical purposes and therefore catalysts and accelerators are used to achieve the polymerisation of the resin within a practical time period. Catalysts are added to the resin

exothermic heating can occur. Addition of certain fillers can also contribute to increasing the fire-resistance of the laminate.

Advantages

Polyester resin offers the following advantages:

1. Adequate resistance to water and variety of chemicals.
2. Adequate resistance to weathering and ageing.
3. Low cost.
4. Polyesters can withstand a temperature up to 80 °C.
5. Polyesters have good wetting to glass fibres.
6. Relatively low shrinkage at between 4–8% during curing.
7. Linear thermal expansion ranges from 100–200 x 10⁻⁶ K⁻¹.

Disadvantages

Polyester resin has the following disadvantages:

1. Strong styrene odor
2. More difficult to mix than other resins, such as a two-part epoxy
3. The toxic nature of its fumes, and especially of its catalyst, MEKP, pose a safety risk if proper protection isn't used
4. Not appropriate for bonding many substrates
5. The finished cure is most likely weaker than an equal amount of an epoxy resin

The different types of Polyester Resin

Orthophthalic polyester resin

This is the standard economic **resin** used by many people.

Polyester resin is a synthetic material manufactured through the reaction between organic acids and alcohols. It can take several forms, including liquid, gel, and film, and has different properties that make it a useful material in many industries. Architects, builders, engineers, and designers all take advantage of the light weight, weatherproof strength of polyester resin in a variety of applications.

Many home-building materials incorporate polyester resin as a source of lightweight strength. Prefabricated shower stalls and closet fixtures are often made of a mixture of polyester resin and acrylic, and decorative metal pieces are often gel-coated with a polyester resin-based colorant to match decor. Many decorative architectural details such as columns and balustrades can be carved from hard foam, coated with fiberglass and polyester resin for strength and weatherproofing, and painted to match the building. Polyester resin's adhesive property is sometimes used to adhere layers of fiberglass in the construction of body panels for automobiles, airplanes, and boats. Its light weight makes it ideal for racing cars and lightweight planes, but its high rate of water retention has caused it

to fall out of favor with boat builders, and it has been mostly replaced in that capacity with epoxy resin. Even steel body panels are occasionally coated with a polyester resin-based colorant for decorative purposes

The ability of polyester resin to be dried into film and formed into sheets while remaining transparent makes it an ideal packaging material. As vacuum forming and heat sealing technology developed, new methods of packaging that used polyester resin as a base material came to the forefront, and still remain the most common forms of small-item packaging today. The same advantages that make polyester resin perfect for packaging also make it ideal for luggage. Suitcases and briefcases often contain polyester resin panels that are reinforced by fabric or leather to make them attractive.

Polyester resin is commonly used to bond the fiberglass on the inside of many "wet" appliances, including dishwashers and washing machines. Despite the association with economy models, fiberglass and resin linings have the advantage over stainless steel interiors in that they do not ding and rust. The same lightweight strength that has made polyester resin popular in so many other applications also makes it useful for the manufacture of patio furniture. It also has the necessary qualities of being waterproof, weather-resistant and inexpensive to replace.

Teraphalic Resin

Is a terephthalic acid based resin, with medium to low reactivity and minimum viscosity. It is recommended for acid resistance applications below 50 deg C. The corrosion resistance properties of terephthalates are on par with isophthalate and mechanical properties being slightly inferior to isophthalate but superior to orthophthalates. This resin is slightly hazy in appearance due to the high crystalline nature of terephthalic acid. The chemical and mechanical properties are not affected due to the haziness of the resin. The thermal and weathering properties of the laminate are better than laminates fabricated with isophthalates.

Isophthalic polyester resin

Isophthalic Polyester is a medium viscosity, Unsaturated Polyester **Resin** based on **Isophthalic** acid. is perfect for fabricating dimensionally stable polyester molds and corrosive service parts. It is often used as a durable repair material for tank linings. This Iso polyester resin offers fast wet-out in spray-up or hand laminates. It is specially designed for corrosion resistant applications. It exhibits excellent mechanical **properties** along with good **chemical resistance** compared with other isophthalates and orthophthalates. For specific Chemical resistant use please contact the office with your specific needs - we will need the concentration of the Acid as well as the normal temperature at which the product is to be stored at.